CHROMOSOME NUMBERS OF GYPSOPHILIC PLANT SPECIES OF THE CHIHUAHUAN DESERT

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This reports original chromosome counts for some dicotyledon species which occur on or are associated with gypsum soils in the Chihuahuan Desert region of North America. Many taxa are absolutely restricted to gypsum while others may also grow on surrounding non-gypsum habitats (Johnston, 1941; Waterfall, 1946). These obligate gypsophiles and facultative gypsophiles include species that constitute unique gypsum floras of the Chihuahuan Desert and elsewhere in western United States and northern Mexica (Powell and Turner, 1975).

The chromosome numbers presented herein were accumulated since 1969 when a chromosomal survey of gypsophilic species was initiated. Major objectives of the chromosomal studies were to compare the percentages of polyploid species on gypsum and non-gypsum substrates and to evaluate the polyploid percentage in the entire Chihuahuan Desert flora. Elsewhere we report (Powell and Sloan, 1977) that the gypsum floras comprise fewer polyploids (17.8%) than non-gypsum vegetation (32.7%), and we calculated an overall polyploid percentage of 30.2 for the Chihuahuan Desert flora. Table 1 presents a large portion of the counts that have contributed to the percentages. A limited number of other counts for gypsophilic taxa have been reported by Turner (1972a, 1972b, 1972c, 1973a, 1973b), Turner, Powell and Watson (1973), Bacon (1974a, 1974b), and a few other workers. We hope eventually to increase the number of counts for gypsophilic and non-gypsophilic species of the Chihuahuan Desert and therefore to refine the accuracy of polyploid percentages in the edaphic-floras. Several hundred species of about 150 genera and 50 families have been estimated to occur on gypsum outcrops of the Chihuahuan Desert. Chromosome numbers are known for about 125 species, about 55 genera and about 25 families, of which 78 species representing 54 genera and 17 families are presented in Table 1.

Information regarding previous reports for the species listed in Table 1 can be found in the chromosome number indexes (Darlington and Wylie, 1956; Cave, 1956-64; Ornduff, 1965-1967; Moore, 1967-1972; Federov, 1969) and other recent literature. Therefore not all of the taxa are commented upon in discussion.

Buds for meiotic analyses were fixed in Modified Carnoy's Solution

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(4 : 3 : 1), and chromosomes were stained with acetocarmine during application of standard squash techniques (Turner and Johnston, 1961). Vouchers are deposited at SRSC, TEX, or US. In Table 1 collection numbers preceded by *P* are by Powell, *Sl* are by Sloan, *Si* are by Sikes, *O* are by Olsen, *Tu* are by Turner, and *To* are by Tomb.

Table 1 reflects the predisposition of certain families, genera, and species to gypsum habitats. Our observations of gypsum vegetation encourage us to draw conclusions about the most prominent families on the unusual substrate, even though this is not necessarily revealed through the taxa for which we present chromosomal data. In terms of number of genera and species, the families most prominently represented on gypsum habitats include Asteraceae, by far the largest, and Cruciferae, Hydrophyllaceae, Boraginaceae, Gramineae, Loasaceae, and Nyctaginaceae. The Nyctage family is not represented in Table 1 because we have not been able to obtain unequivocal chromosome counts for any of its gypsophilic members. Families perhaps less prominent but characteristic on gypsum exposures are Euphorbiaceae, Chenopodiaceae, Leguminosae, Caryophyllaceae, Zygophyllaceae, Onagraceae, Malvaceae, Frankeniaceae, and Amaranthaceae. As suggested in Table 1 certain gypsophilic families and genera contain more polyploid or aneuploid taxa than others. For example, in Asteraceae we have calculated ca. 10% polyploidy for the gypsophilic species, while ca. 27% polyploidy was found for the non-gypsophilic species (data in Table 1, and published elsewhere). Our analysis of the chromosome number reports for Euphorbiaceae by Urbatsch et al. (1975) revealed ca. 60% polyploidy for both the gypsophilic and the non-gypsophilic species of this family in the Chihuahuan Desert region. Eventually we hope to draw conclusions regarding the chromosomal evolution of gypsophilic taxa, but as yet sufficient data are not available to warrant such a discussion.

Sesuvium verrucosum ($n = 8$) occurs in gypseous and non-gypseous, saline habitats and thus the taxon should be regarded as a facultative gypsophile, or perhaps more accurately as a halophytic gypsophile, according to the terminology proposed by Johnston (1941) to denote those gypsophilic taxa that can tolerate concentrations of salts and alkali.

Chromosome numbers are listed for 50 species of Asteraceae, easily the phylad with the most gypsophilic taxa. Most of these species (Table 1) are either dwarf shrubs (19 spp.) or herbaceous perennials (18 spp.), life forms which predominate on gypsum exposures. Large shrubs or trees and annuals are less common on gypsum, although annual facultative gypsophiles are more numerous.

Dicranocarpus parviflorus ($n = 10$) is one of the few annuals that seemingly has an absolute requirement for gypsum. The species ranges throughout most of the Chihuahuan Desert, exhibits considerable exomorphic variability, particularly in fruit characters, but is not known to vary in chromosome number (Turner and Johnston, 1961; Table 1). *Dyssodia acerosa* ($n = 8$) is one of the many facultative gypsophiles that does not exhibit

chromosomal (except $n = 13$ in some non-gypsum habitats) or superficial morphological variability whether growing on gypseous or non-gypseous substrates. High (1974) has demonstrated that cryptic ecotypic differentiation does occur in populations of facultative gypsophiles, and that subtle genetic differences have evolved in some isolated populations of obligate gypsophiles, but studies of this sort are generally lacking for gypsophilic vegetation (Powell and Turner, 1975; Parsons, 1975).

Of the five species of *Flaveria* ($x = 18$) reported in Table 1, only *F. anomala* is considered to be an obligate gypsophile. The other species are commonly found in mixed gypsum-saline habitats.

Turner (1972c) reported tetraploid counts ($n = 34$) for *Gaillardia multiceps* var. *microcephala*, one of the relatively few polyploid gypsophiles. In Table 1 we also list a hexaploid count ($n = 51$) for one population of var. *microcephala*. *Gaillardia* sp. is an undescribed entity seemingly restricted to gypsum in the area of Chihuahua indicated by the localities in Table 1.

The collections of *Machaeranthera* cf. *pinnatifida* ($n = 4,8$), all from "pure" gypsum or gypseous substrates (Table 1) are superficially similar to members of this taxon ($n = 4,8$) found on non-gypseous soils. As stated earlier, the occurrence of facultative gypsophiles such as *Machaeranthera* is possibly correlated with edaphic adaptation, but it has been difficult to detect.

Pseudoclappia arenaria was reported earlier (Powell and Turner, 1963) as $n = 18\pm1$, and our present count (Table 1) is also not unequivocal. A positive number is difficult to ascertain because the chromosomes are small, heteromorphic, univalents or fragments may be present, and one or more bivalents tend to separate early. Although *Pseudoclappia* watsonii is listed as $n = 19$, the chromosome number of this taxon also needs verification.

The species of *Sartwellia*, all $n = 18$ (Table 1), are exclusively gypsophilous, with the possible exception of *S. puberula* which occasionally grows in soils that are weakly or questionably gypseous.

Any distributional or taxonomic significance for the diploid ($n = 11$) and tetraploid ($n = 22$) populations of *Thelesperma megapotamicum* is not immediately apparent. Mostly tetraploid and a few diploid populations of this species also occur on non-gypseous soils (Powell and Sloan, in preparation). The gypsophilic and non-gypsophilic populations are not consistently distinguishable except that gypsophiles in Texas occasionally more closely resemble the Mexican *T. ramosius* ($n = 11$) than other *T. megapotamicum*.

The chromosome number obtained for *Petalonyx crenatus* ($n = 22$) differs from the $n = 23$ that was determined for the other four species of the genus (Davis and Thompson, 1967). *Petalonyx crenatus*, a Coahuila endemic on gypsum, is isolated from the other species which are widespread in the western North America deserts, and so its chromosomal difference is not surprising.

The count listed for *Tetraclea coulteri* ($n = 21$) is a first report for the

genus which has been placed variously in the Verbenaceae and in the Labiateae. In both families there are species with $x = 7$, and both families exhibit taxa with an array of base numbers which could give rise to $n = 21$. The chromosome number of *Tetraclea* may be of value in placing the genus if related genera were studied cytologically.

A chromosome number for the monotypic Mexican endemic *Sericodes greggii* ($n =$ ca. 15) is reported in Table 1. The approximate count was obtained from but three cells which revealed small, light-staining chromosomes, but perhaps it will contribute toward understanding the origin of the related genus *Larrea* ($x = 13$), a North American-South American disjunct (Porter, 1974).

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Table 1. ORIGINAL CHROMOSOME COUNTS FOR OBLIGATE AND FACULTATIVE PLANT GYPSOPHILES OF THE CHIHUAHUAN DESERT

Taxon	Gametic No.	Locality
AIZOACEAE		
**Sesuvium verrucosum* Raf.	8	TEX: Reeves Co. Toyah Lake 4 mi SE Pecos, *P 1911*; 1 mi N of Pecos, *Sl 79*.
	8	MEX: Coah. 12 mi E of Cuatro Cienegas, *P* & *Tu 2279*.
ASTERACEAE		
Aster subulatus Michx.	5	TEX: Culberson Co. 20 mi W of Orla, *Sl 88*.
**Baccharis cf. wrightii* Gray	9[a]	TEX: Brewster Co. near Terlingua *Tu* s.n.
Bahia absinthifolia Benth var. *dealbata* Gray	12	TEX: Culberson Co. 26 mi W of Orla, *Sl 100*; Reeves Co., 6 mi W of Orla, *Sl 53*.

† = seemingly obligate gypsophile
X = halophytic gypsophile
* = previously unreported chromosome number
[a] $n = 9$ II + 1 I, $n = 9$ II, or $n = 8$ II + 1 III.
[b] $n = 9$ II + 0-3 B chromosomes.
[c] *P 2190*, $n = 8$ II plus 2 fragments
[d] frequent multivalents and univalents
[e] *P, T, Si 2458*, with occasional multivalents
[f] with early dividing, heteromorphic bivalents, 1-2 fragments, one multivalent, could be $n = 17$ II + 1 I, $n = 18$ II, or $n = 19$ II.
[g] possibly $n = 18$ II + 1 I.
[h] consistently $n = 18$ II + 2 rings of four
[i] seemingly apomictic, bivalents rarely observed.

†*Bartlettia scaposa* Gray	11	TEX: Hudspeth Co. just E of Tommy's Town, *P 2418*.
Brickellia sp.	9[b]	MEX: Chih. 5 mi W of Presa Granero, *P* & *Tu 2027*.
Erigeron pinkavii Turner	9	MEX: Coah. 18 mi E of Cuatro Cienegas, *P* & *Tu 2270*.
†*Dicranocarpus parviflorus* Gray	10	MEX: N. L. 7.5 mi S of San Roberto junct., *P* & *To 2560*; S. L. P., 28 mi S of Matehuala, *P* & *To 2581*; Zac., 8.5 mi NE of Concepción del Oro, *P* & *To 2598*. TEX: Culberson Co. 26 mi W of Orla, *Sl 111*.
Dyssodia acerosa DC.	8[c]	MEX: Chih. 8.1 mi W of Camargo, *P* & *To 2650*. TEX: Brewster Co. near Terlingua, *P 2390*; Ward Co., 5 mi S of Pyote, *Sl 69*.
†*Ericamera triantha* (Blake) Shinners	9	MEX: 4 mi NW of Cuatro Cienegas, *P* & *Tu 2281*, 5 mi W of Cuatro Cienegas, *P* & *Tu 2293*.
Eupatorium cf. greggii Gray	10	MEX: Coah. 8 mi S of Cuatro Cienegas, *Si*, O, & *P 849*.
Flaveria anomala B. L. Robins	18	MEX: Coah. 26.5 mi N of Concepción del Oro, *P* & *To 2599*; N. L. 7.5 mi S of San Roberto junct., *P* & *To 2559*; 34.4 mi S of San Roberto junct., *P* & *To 2566*; S. L. P. 1 mi N of Matehuala, *P* & *To 2568*; *Si*, O & *P 818*; 28 mi S of Matehuala, *P* & *To 2579*; Zac. 8.5 mi NE of Concepción del Oro, *P* & *To 2594*.
Flaveria chloraefolia Gray	18	MEX: Coah. 12 mi E of Cuatro Cienegas, *P* & *Tu 2278*. TEX: Culberson Co. 20 mi W of Orla, *Sl 73*; Reeves Co. ca. ½ mi E of Toyahvale, *P 2799*.
Flaveria oppositifolia (DC.) Rydb.	18	MEX: Dgo. 9 mi N of Dgo-Zac. border, *Si*, O, & *P 831*; N. L. 45-46 mi SE of Saltillo, *P* & *To 2551*; ca. 44 mi S of Saltillo, *Si*, O, & *P 817*; 14-15 mi S of San Roberto junct., *P* & *To 2561*; Zac. 55 mi NE of junct. 49-54, *P* & *To 2593*.
Flaveria palmeri J. R. Johnst.	18	MEX: Coah. 39 mi N of San Pedro, *P* & *To 2611*; just W of Cuatro Cienegas, *P* & *To 2621*; 67 mi SW of Cuatro Cienegas, *P* & *To 2631*; near Matamoros, *Si*, O, & *P 838*; 15 mi E of Cuatro Cienegas, *Si*, O, & *P 851*.
Flaveria trinervia (Spreng.) C. Mohr	18	MEX: Chih. 3 mi W of Camargo, *P* & *To 2658*; 2-3 mi N of Meoqui, *P* & *To 2660*; S. L. P. ca. 1 mi N of Matehuala, *Si*, O, & *P 819*. TEX: Reeves Co., 1 mi N of Pecos, *P 2204*; Williamson Co., ca. 1 mi N of Liberty Hill, *Si 812*.
†*Gaillardia multiceps* Greene var. *microcephala* Turner	34[d]	NEW MEX: Chaves Co. 1-4 mi N of Dexter, *P 2794*.
	51[d]	TEX: Ward Co. 6 mi S of Pyote, *P 1876*.

Gaillardia pinnatifida Torr.	17	TEX: Culberson Co. 8-15 mi W of Orla, *Sl 26*.
†*Gaillardia turneri* Averett & Powell	17	MEX: Chih. 14 mi W of Presa Granero, *P* & *Tu 2025*; 1.7 mi S of Placer de Guadalupe, *P* & *Tu 2055*.
Gutierrezia microcephala (DC.) Gray	4	TEX: Culberson Co. 20 mi W of Orla, *Sl 90*; Ward Co. 7 mi S of Pyote, *Sl 83*.
Gutierrezia cf. texana (DC.) T. & G.	4	MEX: N. L. between Monclova and Monterrey, *P* & *Tu 2295*.
Gutierrezia sp.	16	TEX: Reeves Co. 7.4 mi E of Pecos, *Sl 40*.
Haploesthes greggii Gray var. *greggii*	18	MEX: Coah. ca. 5 mi W of Oballos, *P* & *Tu 2252*; 1 mi N of Allende, *P* & *Tu 2725*; N. L. Portrero Chico, *P* & *Tu 2331*; near Espinoza *P* & *Tu 2422*.
Haploesthes greggii var. *texana* (Coult.) I. M. Johnst.	18	NEW MEX: Socorro Co. 48.5 mi E of San Antonio, *P 2529*. TEX: Crane Co. near junct. 1053-329, *P 2777*; Crosby Co. near White River Lake Dam, *P 2787*; Ward Co., just S of Pyote, *P 1899*; 6 mi E of Grandfalls, *P 2358*.
Haploesthes greggii cf. var. *texana* (Coult.) I. M. Johnst.	18	TEX: Brewster Co. 1.5 mi W of Terlingua, *High* & *High 99*; Val Verde Co. just N of Langtry, *P 2678*.
×*Haploesthes robusta* I. M. Johnst.	18	MEX: Coah. 3-4 mi SW of Cuatro Cienegas, *P* & *To 2619*.
†*Hymenoxys odorata* DC.	15	MEX: N. L. 45-46 mi SE of Saltillo, *P* & *To 2554*.
Isocoma coronopifolia (Gray) Greene	6	MEX: ca. 15 mi E of Cuatro Cienegas, *P* & *Tu 2271*.
Isocoma wrightii (Gray) Rydb.	6	TEX: Culberson Co. 16 mi W of Orla, *Sl 57*; 29 mi N of Van Horn, *P 2788*; Reeves Co. 1 mi N of Pecos, *Sl 58*.
Isocoma wrightii (Gray) Rydb.	ca.12	TEX: Hurspeth Co. ca. 1 mi E of Tommy's Town, *P 2791*.
Leucelene ericoides (Torr.) Greene	8	TEX: Culberson Co. 34 mi N of Van Horn, *P 2395*.
Machaeranthera cf. *pinnatifida* (Hook.) Shinners	4	MEX: Coah. 35.5 mi N of Concepción del Oro, *P* & *To 2601*; 67 mi SW of Cuatro Cienegas, *P* & *To 2632*; 45 mi SW of Cuatro Cienegas, *Tu 6003*. Chih. 11.5 mi W of Camargo, *P* & *To 2641*; 8.1 mi W of Camargo, *P* & *To 2651*. N. L. Garcia Caves, *Tu 6378*. TEX: Culberson Co. 36 mi N of Van Horn, *P 1943*; Reeves Co. 4 mi W of Orla, *Sl 45*; 7 mi SE of Pecos, *Sl 117*.
Machaeranthera cf. *pinnatifida* (Hook.) Shinners	8°	MEX: Chih. 20 mi W of Ojinaga, *P*, *Tu*, & *Sl 2458*.

Machaeranthera tanacetifolia (H.B.K.) Nees	4	TEX: Reeves Co. 7.4 mi SE of Pecos, *Sl 35*.
Melampodium leucanthum T. & G.	10	TEX: Brewster Co. near Terlingua, *P 2388*; Jeff Davis Co. Near Black's Tunnel, *Si & Babcock 312*; Reeves Co. 6 mi W of Orla, *Sl 50*.
Peritylc parryi Gray	17	MEX: Chih. 6 mi W of Presa Granero, *P & Tu 2030*; *2049*.
†*Peritylc rascyi* Coult.	17	MEX: Chih. 6.5 mi S of Ojinaga, *P & Tu 2002*. TEX: Brewster Co. 1.5 mi W of Terlingua, *Higb & Higb 97*.
§*Pseudoclappia arenaria* Rydb.	18[f]	TEX: Reeves Co. 1 mi N of Pecos *P 1907*; *2142*.
*‡*Pseudoclappia watsonii* Powell & Turner	ca. 19[g]	TEX: Hudspeth Co. just E of Tommy's Town, *P 2413*.
Pslostrophe cf. tagetina (Nutt.) Greene	16	TEX: Culberson Co. 25.6 mi W of Orla, *Sl 77*; 34 mi N of Van Horn, *P 2394*; Reeves Co. 7.4 mi SE of Pecos, *Sl 36*; Ward Co. 6 mi E of Grandfalls, *P 2368*.
†*Sartwellia flaveriae* Gray	18	NEW MEX: Chaves Co. 1-4 mi N of Dexter, *P 2796*. TEX: Crane Co. 13 mi E of Grandfalls, *Meyer 30*; Culberson Co. 45 mi N of Van Horn, *P 2122*; Reeves Co., 8 mi W of Orla, *Sl 31*; 4 mi W of Orla, *Sl 46*; 5 mi W of Orla, *P 1917*.
†*Sartwellia mexicana* Gray	18	MEX: Coah. 0.5 mi S of Est. Hermanas, *P & To 2548*; S. L. P. 1 mi N of Matehuala, *P & To 2570*; 28 mi S of Matehuala, *P & To 2580*; Zac. 8.5 mi N of Concepción del Oro, *P & To 2595*; 55 mi NE of junct. 49-54, *P & To 2592*.
†*Sartwellia pubernla* Rydb.	18	MEX: Coah. 61 mi W of Saltillo, *P & To 2609*; 40 mi N of Sal Pedro, *P & To 2613*; 38 mi SW of Cuatro Cienegas, *P & To 2626*; 68 mi SW of Cuatro Cienegas, *P & To 2634*; 67 mi N of San Pedro, *Si, O, & P 843*; Chih. 12 mi W of Camargo, *P & To 2635*; ca. 27 mi NE of El Morrión, *P & To 2666*.
†°*Sartwellia gypsophila* Powell & Turner	18	MEX: Chih. ca. 5 mi W of Presa Granero, *P 2836*.
†°*Senecio warnockii* Shinners	20	TEX: Culberson Co. 20 mi W of Orla, *Sl 93*.
Stephanomeria pauciflora (Torr.) A. Nels.	8	MEX: Chih. 6.5 mi S of Ojinaga, *P & Tu 2003*. TEX: Presidio Co. NW of Candelaria, *Higb & Gallagher 79*.
Strotheria gypsophila Turner	8	MEX: N. L. 15.7 mi S of San Roberto junct., *P & To 2565*.
Thelesperma longipes Gray	10	TEX: Brewster Co. near Terlingua, *P 2385*.
Thelesperma megapotamicum (Spreng.) Kuntz.	11	TEX: Culberson Co. 22 mi W of Orla, *Sl 96*.
Thelesperma megapotamicum (Spreng.) Kuntz.	ca. 11	TEX: Ward Co. 7.6 mi S of Pyote, *Sl 85*.
Thelesperma megapotamicum		

(Spreng.) Kuntz.	22[h]	MEX: Coah. 1 mi N of Allende, *P* & *Tu 2726*. NEW MEX: Chaves Co. 1-4 mi N of Dexter, *P 2795*.
Thelesperma megapotamicum (Spreng.) Kuntz.	ca. 22	MEX: Chih. 15 mi SE of El Morrión, *P 2432*. TEX: Culberson Co. 34 mi N of Van Horn, *P 2404*; Reeves Co. 7.4 mi SE of Pecos, *Sl 37*; *114*; *116*.
†*Thelesperma ramosius* Blake	11	MEX: Coah. 1 mi S of Est. Hermanas, *P* & *Tu 2264*.
†*Thelesperma scabridulum* Blake	12	MEX: Coah. 35.5 mi N of Concepción del Oro, *P* & *To 2600*.
Varilla mexicana Gray	18	MEX: Coah. Las Delicias, *P* & *Tu 2698*.
Verbesina encelioides (Cav.) Gray	17	TEX: Reeves Co. 7.4 mi SE of Pecos *Sl 43*; Ward Co., 5 mi S of Pyote, *Sl 67*.
†*Xylorhiza wrightii* (Gray) Greene	6	MEX: Chih. 10.4 mi S of Ojinaga, *P* & *Tu 2017*.
BORAGINACEAE		
†**Coldenia hispidissima* (Torr.) Gray	9	TEX: Culberson Co. 36 mi N of Van Horn, *P 1939*; Reeves Co. 5 mi W of Orla, *P 1914*; Ward Co. 6 mi E of Grandfalls, *P 2355*.
CARYOPHYLLACEAE		
†**Drymaria cf. lyropetala*	12	MEX: N. L. between Monclova and Monterrey *P* & *Tu 2304*.
†**Drymaria sp.*	12	MEX: Chih. ca. 7 mi NW of Presa Granero, *P 2433*.
CHENOPODIACEAE		
×**Suaeda suffrutescens* Wats.	ca. 9	TEX: Reeves Co. 4 mi W of Orla, *Sl 47*.
CRUCIFERAE		
Lepidium montanum Nutt.	16	NEW MEX: Socorro Co. 48.5 mi E of San Antonio, *P 2531*. TEX: Culberson Co., 20 mi W of Orla, *Sl 91*; 34 mi N of Van Horn, *P 2400*; Hudspeth Co., W of Guadalupe Mts., *P 2409*; Reeves Co., 8 mi W of Orla, *Sl 23*; 7.4 mi SE of Pecos, *Sl 41*; Ward Co., 5 mi S of Pyote, *Sl 62*; 6 mi E of Grandfalls, *P 2357*.
Nerisyrenia camporum (Gray) Greene	9	MEX: Chih. 11.5 mi W of Camargo, *P* & *To 2640*.
Nerisyrenia camporum (Gray) Greene	ca. 18	NEW MEX: Doña Ana Co. E. side of San Andres Mts., *Spellenberg* & *Todsen 2644*.
†*Nerisyrenia gypsophila* Bacon	9	MEX: Chih. near Presa Granero *P* & *Tu 2026*.
†*Nerisyrenia linearifolia* (Wats.) Greene	9	TEX: Culberson Co., 20 mi W of Orla, *Sl 74*; 34 mi N of Van Horn, *P 2397*.
†*Nerisyrenia linearifolia* (Wats.) Greene	18	TEX: Reeves Co., 7.4 mi SE of Pecos, *Sl 39*; Ward Co. 5 mi S of Pyote, *Sl 63*.

**Streptanthus carinatus* Wright	14	MEX: Chih. 20 mi W of Ojinaga, *P*, *Tu*, & *Si 2457*.
EUPHORBIACEAE		
Croton dioicus Cav.	14	TEX: Ward Co. 6 mi E of Grandfalls *P 2372*.
Croton dioicus Cav.	21	TEX: Culberson Co. 26 mi W of Orla, *Sl 99*.
GENTIANACEAE		
†**Centarium sp.*	ca. 401	MEX: Chih. 27 mi NE of El Morrión, *P*, *Tu*, & *Si 2487*.
HYDROPHYLLACEAE		
Nama hispidum Gray	7	MEX: Chih. 20 mi W of Ojinaga, *P*, *Tu*, & *Si 2460*.
†**Phacelia gypsogenia* I. M. Johnst.	11	MEX: Chih. ca. 6 mi SE of El Morrión, *P* & *Tu 2689*.
†**Phacelia cf. integrifolia* Torr.	11	TEX: Brewster Co., near Terlingua, *P 2384*; Presidio Co. ca. 10 mi W of Candelaria, *High* & *Gallagher 90*; Reeves Co. 7 mi SE of Pecos, *Sl 115*.
LINACEAE		
**Linum puberulum* (Engelm.) Heller	15	TEX: Ward Co. 7 mi S of Pyote, *Sl 120*.
LOASACEAE		
Eucnide lobata (Hook.) Gray	21	MEX: N. L. Puerto Chico, near Monterrey, *P* & *Tu 2332*.
†*Mentzelia humilis* (Gray) Darl.	10	TEX: Culberson Co. 34 mi N of Van Horn, *P 2399*; Reeves Co. 6 mi W of Orla, *Sl 49*; 5 mi W of Orla, *P 1912*.
Mentzelia multiflora (Nutt.) Gray subsp. *multiflora*	9	TEX: Reeves Co. 7.4 mi SE Pecos, *Sl 34*.
Mentzelia saxicola H. J. Thoms. & Zavor.	10	MEX: Chih. 27 mi NE of El Morrión, *P*, *Tu*, & *Si 2498*; 8.1 mi W of Camargo, *P* & *To 2647*.
Mentzelia sp.	10	TEX: Hudspeth Co. 22 mi S of Tommy's Town, *P 2422*.
†**Petalonyx crenatus* Gray ex S. Wats.	22	MEX: Coah. 2 mi off hwy. toward Las Delicias, *P 2697*.
MALVACEAE		
†**Sphaeralcea subhastata* Coult.	10	TEX: Culberson Co. 34 mi N of Van Horn, *P 2396*; Ward Co. 5 mi S of Pyote, *Sl 60*.
ONAGRACEAE		
Calylophus hartwegii Benth. (Raven) subsp. *filifolius* (Eastw.) Towner & Raven	7	TEX: Culberson Co. 34 mi N of Van Horn, *P 2403*; Reeves Co. 6 mi W of Orla, *Sl 52*.

SCROPHULARIACEAE		
**Castilleja sp.*	12	MEX: N. L. between Monclova and Monterrey, *P & Tu 2306*; Chih. 15 mi SE of El Morrión, *P 2435*.
SOLANACEAE		
Chamaesaracha villosa Rydb.	12	MEX: Chih. 20 mi W of Ojinaga, *P, Tu,* & *Si 2465*.
Physalis hederaefolia Gray	12	MEX: N. L. between Monclova and Monterrey, *P & Tu 2307*.
VERBENACEAE		
**Tetraclea coulteri* Gray	21	MEX: Coah. ca. 30 mi NE of San Pedro, *P & Tu 2690*.
ZYGOPHYLLACEAE		
†**Sericodes greggii* Gray	ca. 15	MEX: Coah. ca. 54 mi N of San Pedro, *Si, O,* & *P 842*.
Larrea tridentata (DC.) Cov.	13	TEX: Hudspeth Co. 1 mi S of Tommy's Town, *P 1560*.

REFERENCES

BACON, J. D. 1974a. Chromosome numbers and taxonomic notes in the genus *Nama* (Hydrophyllaceae). Brittonia 26: 101-105.

———. 1974b. The genus *Nerisyrenia* (Cruciferae): A chemosystematic and cytotaxonomic study. Ph. D. Thesis, The University of Texas, Austin.

CAVE, M. S. [ed.]. 1956-1964. Index to plant chromosome numbers. University of North Carolina Press, Chapel Hill.

DARLINGTON, D. C. and A. P. WYLIE. 1956. Chromosome Atlas of Flowering Plants. George Allen and Unvin Ltd., London.

DAVIS, W. S. and H. J. THOMPSON. 1967. A revision of *Petalonyx* (Loasaceae) with a consideration of affinities in subfamily Gronovioideae. Madroño 19: 1-18.

FEDEROV, A. A. [ed.]. 1969. Chromosome Numbers of Flowering Plants. Acad. Sci. U.S.S.R., Komarov Botanical Institute, Leningrad.

HIGH, S. D. 1974. A populational study of several gypsum restricted taxa in Trans-Pecos Texas. M. S. Thesis, Sul Ross State University, Alpine, Texas.

JOHNSTON, I. M. 1941. Gypsophily among Mexican desert plants. J. Arn. Arb. 22: 145-170.

MOORE, R. J. [ed.]. 1967-1971, 1972. Index to plant chromosome numbers. International Bureau for Plant Taxonomy and Nomenclature, Utrecht, Netherlands. Regnum Veg. v. 90, 91.

ORNDUFF, R. [ed.]. 1965-1967. Index to plant chromosome numbers. International Bureau for Plant Taxonomy and Nomenclature, Utrecht, Netherlands. Regnum Veg. v. 50, 55, 59.

PARSONS, R. F. 1975. Gypsophily in plants—a review. Amer. Mid. Nat. 96: 1-20.

PORTER, D. M. 1974. Disjunct disturbutions in the New World Zygophyllaceae. Taxon 23: 339-346.

POWELL, A. M. and S. A. SLOAN. 1975. Polyploid percentages in gypsum and non-gypsum floras of the Chihuahuan Desert. Sci. Biol. J. 1: 37-38.

———, and B. L. TURNER. 1963. Chromosome numbers in the Compositae. VII. Additional species from the southwestern United States and Mexico. Madroño 17: 128-140.

———. 1977. Aspects of the plant biology of the gypsum outcrops of the Chihuahuan Desert. In Transactions—Symposium on the Biological Resources of the Chihuahuan Desert Region, U. S. and Mexico. National Park Service, Washington, D. C.

TURNER, B. L. 1972a. Two new species of *Isocoma* (Compositae—Astereae) from north central Mexico. Sida 5: 23-25.

———. 1972b. *Strotheria* (Compositae—Tageteae) a new monotypic genus from north central Mexico. Amer. J. Bot. 59: 180–182.
———. 1972c. Two new gypsophilous species of *Gaillardia* (Compositae) from north central Mexico. Southwest. Nat. 17: 181–190.
———. 1973a. Two new gypsophilous species of *Machaeranthera* (Asteraceae—Astereae) from north central Mexico. Phytologia 26: 116–120.
———. 1973b. *Machaeranthera restiformis* (Asteraceae) a bizarre new gypsophile from north central Mexico. Amer. J. Bot. 60: 836–838.
———, and M. C. JOHNSTON. 1961. Chromosome numbers in the Compositae. III. Certain Mexican species. Brittonia 13: 64–69.
———, A. M. POWELL, and T. J. WATSON. 1973. Chromosome numbers in Mexican Asteraceae. Amer. J. Bot. 60: 592–596.
URBATSCH, L. E., J. D. BACON, R. L. HARTMAN, M. C. JOHNSTON, T. J. WATSON, and G. L. WEBSTER. 1975. Chromosome numbers for North American Euphorbiaceae. Amer. J. Bot. 62: 494–500.
WATERFALL, U. T. 1946. Observations on the desert gypsum flora of southwestern Texas and adjacent New Mexico. Amer. Mid. Nat. 36: 456–466.